
APPENDIX F: FIXED VOICE AND DATA SERVICES

As Congress and the Commission have looked for new ways to promote competition in the telecommunications industry, it has become clear that wireless licensees providing fixed wireless services have the potential to create facilities-based competition in numerous industries beyond the traditional mobile markets. While spectrum classified as CMRS is being utilized in this manner,¹ non-CMRS spectrum, including Multipoint Multichannel Distribution Service ("MMDS"), 3.5 GHz, Digital Electronic Message Service ("DEMS"), Local Multipoint Distribution Service ("LMDS"), and 39 GHz, are also being used.

In this section, the Commission reviews the state of competition provided by fixed wireless operators for voice and data services in both residential and business markets. For discussion purposes, the operators are trifurcated by spectrum bands - cellular/broadband PCS, 2 GHz to 4 GHz, and Upperband spectrum. The Commission also examines some of the challenges these operators face, as well as some of their strengths.

A. Fixed Wireless Access

In a fixed wireless access system, a provider attaches a radio transmitter to a customer's premises that communicates with a central antenna site. This antenna site acts as the gateway into the PSTN or the Internet. This technology functions as a replacement for the "last mile" of copper wire that has traditionally provided individual customers with telecommunications services, thus allowing a wireless provider to compete with a traditional wireline service provider. The "last mile" is also referred to as the "local loop;" thus, fixed wireless access is often referred to as "Wireless Local Loop" or "WLL" for short.²

B. Service Providers

1. Cellular (800 MHz) / Broadband PCS (1900 MHz)

One analyst predicts that, worldwide, WLL systems using cellular/broadband PCS spectrum will have the greatest number of WLL subscribers in the future, growing from an estimated 5.8 million in 2001 to 22 million in 2005.³ In the United States, the current WLL in these bands is

¹ "Licensees of cellular systems may use alternative cellular technologies and/or provide fixed services on a co-primary basis with their mobile offerings, including personal communications services . . . on the spectrum within their assigned channel block." 47 CFR § 22.902(d).

² The terminology of fixed wireless technology is still being developed, and operators and equipment manufacturers often use generic terms in a proprietary way. AT&T, for example, refers to its fixed wireless technology as "Fixed Wireless Service." Nortel refers to its technology as "Fixed Wireless Access."

³ WIRELESSNOW, Sep. 16, 1998, citing Global Wireless Local Loop Markets: 1998, THE STRATEGIS GROUP (1998).

still in an early stage of development, is currently targeted at low-use/residential subscribers, and is secondary to the mobile products of service providers.

Centennial Cellular Corp. ("Centennial") - Centennial has been operating a WLL system in Puerto Rico since 1997 using its broadband PCS spectrum.⁴ Centennial offers both mobile and fixed services from the same platform. Centennial was serving 14,200 "HomePhone" customers as of November 30, 1998.⁵ The HomePhone unit looks and functions like a conventional telephone and supports call waiting, conference calling, call transfer, voice mail, one-touch redial, and other features.⁶ HomePhone service costs \$29.95 per month for 250 off-peak minutes and 30 peak minutes.⁷ This rate is for fixed use only: subscribers incur additional charges if they use the phone as a mobile unit.⁸ The phone can either be leased or purchased.⁹ All calls within Puerto Rico are local and incoming calls are free.¹⁰

Western Wireless Co. ("WWC") - WWC is operating fixed wireless systems in Nevada and North Dakota using its cellular licenses. Under an agreement reached between Nevada Bell, the Nevada Public Service Commission, and WWC to expand basic telephone service to a previously unserved region, WWC provides dialtone service to two small rural communities, Antelope Valley and Reece, using its cellular infrastructure.¹¹ Operating basically as a

⁴ *Bringing Local Loop to Puerto Rico*, WIRELESS BUSINESS & TECHNOLOGY, Jan. 1998, at 27.

⁵ Centennial Cellular Corp., Form S-4, Mar. 3, 1999, at 6. These numbers include Centennial's product aimed at business customers, known as "BusinessPhone." See Centennial de Puerto Rico, *Centennial's Wireless System: Benefits & Advantages of Centennial's Wireless Products & Services* (visited Feb. 27, 1999) <<http://www.centennialpr.net/wireless.htm>>.

⁶ In addition to an AC power adapter, the phone comes with a 12-volt DC power pack that can be used during power outages or, for example, when the customer wants to take the phone outside. Centennial de Puerto Rico, *Centennial Scores a First with CDMA Fixed Wireless Phones* (visited Feb. 26, 1999) <<http://www.qualcomm.com/cdma/bulletin/centennial.html>>

⁷ *Un Telefono Que Se Activa Con Solo Enchufarlo*, Promotional Flyer, Centennial de Puerto Rico, Mar. 3, 1999. Additional minutes cost extra. There is also a plan costing \$39.95 per month, which includes 500 off-peak minutes and 90 peak minutes. *Id.*

⁸ *Un Telefono Que Se Activa Con Solo Enchufarlo*, Promotional Flyer, Centennial de Puerto Rico, Mar. 3, 1999.

⁹ *Id.* There is a \$69.95 activation charge if you lease the phone. The unit costs \$299. *Id.*

¹⁰ *Bringing Local Loop to Puerto Rico*, WIRELESS BUSINESS & TECHNOLOGY, Jan. 1998, at 27. Centennial does not charge for incoming calls because it is compensated by Puerto Rico Telephone Co., the local LEC, for connecting them.

¹¹ According to the WWC, it was able to bring service to the region with approximately \$100,000 worth of infrastructure improvements. WWC claims it would have cost over \$1 million to provide wired service to the approximately 50 customers in the region. *Western Wireless Seeks Universal Service Fund Subsidies for Rural Operations*, PCS WEEK, Jul. 22, 1998.

subcontractor to Nevada Bell, WWC provides service at the regular tariffed wireline local rate to the 50 residents of the region.¹² Users connect to the PSTN by way of a laptop-sized unit provided by WWC. The unit is basically a cellular phone with a phone jack.¹³

In the small town of Regent, North Dakota, WWC set up a similar network, but as a CLEC and without support from the state.¹⁴ Inaugurated on January 7, 1999,¹⁵ it was turned off four days later by Consolidated Telephone Cooperative ("CTC"), the ILEC for the area.¹⁶ CTC, through which WWC connected to the PSTN, disconnected WWC's customers, claiming that WWC's interconnection agreement permitted "cellular calls and not . . . competitive local exchange service."¹⁷ After a phone conference with the North Dakota Public Service Commission and the Federal Communications Commission, CTC agreed to reconnect WWC's customers.¹⁸ As of February 8, 1999, WWC had signed up 40 customers, 20 percent of the town's 268 residents.¹⁹ WWC's fixed local loop service is priced at \$14.99 per month versus \$16.00 for CTC²⁰ and the

¹² *Western Wireless Seeks Universal Service Fund Subsidies for Rural Operations*, PCS WEEK, Jul. 22, 1998. Nevada Bell makes up the difference between the tariffed rate and WWC's cellular rates. Conversation with Christopher Johnson, Manager, Regulatory Affairs, Western Wireless Corp., Mar. 18, 1999.

¹³ The prototype unit, made by Telular Corp., costs approximately \$500, but is expected to be about half that price in mass production. Sound quality and data rates are those of WWC's AMPS-based cellular system in that area. Conversation with Christopher Johnson, Manager, Regulatory Affairs, Western Wireless Corp., Mar. 18, 1999.

¹⁴ Western Wireless spent \$350,000 building a cell site near town and leased 2,000 phone numbers from the local telephone company for \$320 per month. Bryan Gruley, *Battle Lines: As Phone Wars Move to Rural Towns, Tactics Are Growing Rougher; Fighting for Clients, Cash from Subsidies, Upstart Finds Its Main Cable Cut; 'Not the 900-Pound Gorilla,'* THE WALL STREET JOURNAL, Feb. 10, 1999 ("Gruley").

¹⁵ North Dakota Governor Edward Shafer and Western Wireless CEO John Stanton placed the inaugural calls on Regent's new system to North Dakota Senator Byron Dorgan and Federal Communications Commission Chairman William Kennard. Regent, ND is the home town of Sen. Dorgan. WIRELESSNOW, Jan. 8, 1999. WWC picked Regent because Sen. Dorgan, addressing an industry conference two years ago, challenged Mr. Stanton to demonstrate that he could provide competition in Regent and thereby show that wireless technology can provide competition anywhere. *Gruley*.

¹⁶ *Incumbent Shuts Down Competitive Wireless LEC: Service Is 'Unauthorized,'* COMMUNICATIONS DAILY, Jan. 12, 1999.

¹⁷ *Id.*

¹⁸ *ND LEC Cuts Western Wireless Service*, WIRELESSNOW, Jan. 18, 1999 <<http://www.commnw.com/>>. However, litigation in this case continues. See, e.g., Expedited Motion for Preliminary Injunctive Relief of Western Wireless Corp., Western Wireless Corp. v. Consolidated Telephone Cooperative, Case No. PU-1564-99-17 (N.D. P.S.C. filed Jan. 15, 1999); Complaint of Western Wireless Corp., Western Wireless Corp. v. Consolidated Telephone Cooperative (FCC filed Jan. 29, 1999).

¹⁹ CTIA Notebook, COMMUNICATIONS DAILY, Feb. 9, 1999.

²⁰ *Gruley*.

local calling area includes 15 communities versus two communities for CTC.²¹

AT&T - In February 1997, AT&T announced the development of a "revolutionary fixed wireless technology," code-named "Project Angel."²² The system, operating on AT&T's broadband PCS spectrum, was to provide subscriber households with two phone lines and the capability for high-speed Internet access at 128 kbps.²³ After running field trials of the system in Chicago in late 1997,²⁴ AT&T put the project on hold, reportedly because of concern over high implementation costs.²⁵ In February 1999, AT&T announced that it would resume tests of Project Angel.²⁶ In May, the company began offering free fixed wireless service in Dallas a part of its testing of the system.²⁷ AT&T plans to introduce local commercial voice and data services in select cities by 2000.²⁸

2. 2 GHz to 4 GHz

Commercial and trial services in these bands, primarily by wireless cable licensees, target both business and residential customers.

a. Wireless Cable

²¹ CTIA Notebook, COMMUNICATIONS DAILY, Feb. 9, 1999. WWC CEO John Stanton claims that WWC provides service at a fraction of the \$200 monthly per subscriber subsidy covered by the Universal Service Fund. *Id.*

²² *AT&T's Breakthrough Wireless Technology New Alternative for Local Service*, News Release, AT&T Corp., Feb. 25, 1997.

²³ The new system was designed to connect a consumer's home to an AT&T digital switching center via a neighborhood antenna mounted on a utility pole or other structure. A single antenna could serve up to 2,000 homes. The only new equipment required on the customer's house is a transceiver about the size of a pizza box that can be mounted on the side or back of a house. *Id.*

²⁴ *Fixed Wireless Service: Questions & Answers*, AT&T Corp. Promotional Brochure, May 1997.

²⁵ Peter Elstrom, *AT&T's Wireless Path to Local Service: "Project Angel" Will Back Up Ma Bell's Cable Forays*, BUSINESS WEEK, Dec. 28, 1998.

²⁶ *Cell Phones, PDAs Merge*, PCS WEEK, Feb. 15, 1999.

²⁷ *Dallas Tapped for Project Angel Fixed Wireless Trial*, WIRELESSNOW, May 20, 1999.

²⁸ *Cell Phones, PDAs Merge*, PCS WEEK, Feb. 15, 1999. There are other trials as well. For example, in October 1998, Pioneer Holdings, LLC, owned by Long Line Limited, MCI, and Northwest Iowa Power Cooperative (NIPCO), joined two other companies in launching a fixed wireless access trial to 25 customers outside of Hayward, IA. Karissa Todd, *The Road to Local Competition*, WIRELESS REVIEW, Nov. 30, 1998. *See also*, Pioneer Holdings, LLC, *Projects* (visited Feb 28, 1999) <<http://www.pioneerholdings.com/site/new/projects.html>>.

MMDS licensees, also referred to as "wireless cable" operators,²⁹ originally purchased licenses in the 2 GHz spectrum band to provide television programming to residential customers. However, many MMDS operators found it difficult to compete with cable in this market due to the high capital costs of building out wireless cable systems³⁰ and the lower channel capacities of MMDS relative to those of wireline cable and direct-to-home satellite companies.³¹ These difficulties resulted in low subscriber numbers and financial strain for several MMDS companies.³² However, as an innovative business opportunity, many wireless cable companies have begun to focus on offering high-speed Internet access³³ and telephony instead of television programming, and have shown early success in these endeavors.³⁴

The Commission's September 1998 order authorizing wireless cable operators to offer two-way services cleared the way for another major competitor to enter the broadband services market.³⁵ The Commission's Order established a framework for allowing MMDS operators to offer, quickly and easily, two-way high-speed Internet access service, as well as other two-way

²⁹ Multichannel Video Programming Distributors ("MVPD") that use microwave frequencies in the multichannel multipoint distribution service ("MMDS"), multipoint distribution service ("MDS"), and instructional television fixed service ("ITFS") to transmit video programming to subscribers equipped with special rooftop antennas are typically referred to as MMDS or wireless cable systems. *See Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming, Third Annual Report*, 12 FCC Rcd 4358, 4386 n. 152 (1997).

³⁰ *Heartland Wireless and Wireless One Dropping Video Focus*, COMMUNICATIONS DAILY, Mar. 22, 1999 ("COMM. DAILY 3/22/99").

³¹ *See Annual Assessment of the Status of Competition in Markets for the Delivery of Video Programming, Fifth Annual Report*, FCC 98-335 (rel. Dec. 23, 1998), at ¶ 82. The maximum capacity of analog MMDS is 33 channels, while 62 percent of all cable television subscribers received at least 54 channels in October 1998. *See Id.*, at ¶¶ 19-21, 82.

³² In April 1998, Standard & Poor's lowered its debt rating on all wireless cable companies to CCC+ or lower, stating that analog wireless was not a viable competitor to cable. *S&P Says Analog Wireless Cable Isn't Viable, Downgrades Industry*, COMMUNICATIONS DAILY, Apr. 17, 1998. On July 30, 1998, CAI Wireless Systems, Inc. declared bankruptcy. CAI Wireless Systems, Inc., Form 8-K, Aug. 4, 1998. On October 7, 1998, Heartland Wireless Systems, Inc. declared bankruptcy. *S&P Says Analog Wireless Cable Isn't Viable, Downgrades Industry*, COMMUNICATIONS DAILY, Apr. 17, 1998.

³³ *See Table 1 at F-16 for a summary of Internet access offerings by wireless cable operators. Heartland's Bankruptcy May Set Back 2-Way Wireless Internet*, COMMUNICATIONS DAILY, Oct. 9, 1998; *Wireless Cable Told to Focus on Wholesaling, Internet*, COMMUNICATIONS DAILY, Oct. 27, 1998; *MMDS Companies Realign Their Interests; Announce Cooperation on Flexible 2-Way Use of Their Spectrum*, News Release, Heartland Wireless Communications, Inc., Dec. 3, 1998.

³⁴ *See Wireless Communications Association International Comments*, at 21, *Annual Assessment of the Status of Competition in Markets for the Delivery of Video Programming*, CS Docket No. 98-102 (Jul. 31, 1998).

³⁵ *See Amendment of Parts 1, 21, and 74 to Enable Multipoint Distribution Service and Instructional Television Fixed Service Licensees to Engage in Fixed Two-Way Transmission, Report and Order*, FCC 98-231 (rel. Sep. 25, 1998).

services, such as telephony, video conferencing, and distance learning.³⁶ Prior to the Order, MMDS operators sought waivers from the Commission to provide Internet access and used a telephone line modem for the upstream connection.

In March 1999, Wireless One, Inc. ("Wireless One") and Heartland Wireless Systems, Inc. (which changed its name to Nucentrix on April 1, 1999) announced that they would emerge from bankruptcy with business plans focused on offering high-speed Internet access mainly to small businesses and home offices.³⁷ The companies stated they would not expand their video operations, but would continue operating their existing systems through partnerships with direct-to-home satellite companies.³⁸ Later that month, MCI WorldCom invested \$200 million in four wireless cable companies including Wireless One, CAI Wireless Systems, Inc. ("CAI Wireless"), People's Choice TV Corp., and CS Wireless Systems, Inc.³⁹ Industry observers speculated that the investment would become a core part of MCI WorldCom's strategy for offering high-speed Internet access to consumers.⁴⁰ In April 1999, MCI WorldCom acquired the remaining equity of CAI Wireless. During that same month, Sprint acquired People's Choice TV Corp. and American Telecasting.⁴¹ Almost all MMDS operators have stated that they plan to offer more data and telephony services in 1999.⁴²

In addition to the traditional wireless cable operators, there are several wireless cable licensees who were not previously video programming distributors, but instead provide Internet access. These entities tend to be start-up companies using MMDS or low-power television licenses. For example, IJNT International (formerly InterJetNet, Inc.) was founded in 1997 and now offers wireless Internet access in six cities.⁴³ SkyLynx Communications, Inc., operating at 2.4 GHz, was formed in 1996 and offers two-way, high-speed, advanced data services in Florida and California.⁴⁴ The company is focusing on small to medium sized businesses and Multiple

³⁶ See Mike Farrell, *Wireless Ops Hope Two-Way Ruling Helps*, MULTICHANNEL NEWS, Sep. 28, 1998, at 3, 32 ("Farrell"); Annual Assessment of the Status of Competition in Markets for the Delivery of Video Programming, *Fifth Annual Report*, FCC 98-335 (rel. Dec. 23, 1998).

³⁷ COMM. DAILY 3/22/99.

³⁸ COMM. DAILY 3/22/99.

³⁹ Rebecca Blumenstein and Nicole Harris, *MCI WorldCom Purchases the Debt of Group of Wireless-Cable Concerns*, THE WALL STREET JOURNAL, Mar. 30, 1999; *MCI WorldCom's Wireless Cable Plans Seen Widening Broadband Options*, COMMUNICATIONS DIALY, Mar. 31, 1999.

⁴⁰ *Id.*

⁴¹ Nicole Harris, *Sprint to Purchase Wireless-Cable Firm American Telecasting for \$167.8 Million*, THE WALL STREET JOURNAL, Apr. 28, 1999.

⁴² *MMDS Industry Facts*, PRIVATE CABLE & WIRELESS CABLE, Dec. 1998, at 13.

⁴³ IJNT International/UrJet InterNet, *UrJet Internet* (visited Jun. 14, 1999) <<http://www.urjet.net/urjet.taf>>.

⁴⁴ *SkyLynx Communications, Inc. Announces Commencement of Trading*, News Release, SkyLynx

Dwelling Units, such as apartment buildings and condominiums, in second-tier cities.⁴⁵

b. Other Providers

CFW Communications ("CFW")- CFW conducted a wireless local loop trial in 1998 using its MMDS spectrum. It was able to broadcast from a central cell site to terminals up to 30 miles away and obtained two-way voice capabilities with the quality of a landline connection. CFW is considering building a WLL for commercial purposes.⁴⁶

Salt River Pima-Maricopa Reservation - On December 11, 1998, Arizona Senator McCain placed the inaugural call on an experimental fixed wireless system located on the Salt River Pima-Maricopa Reservation, a 56,000-acre Indian reservation near Scottsdale, AZ.⁴⁷ The system, using Nortel's "Proximity I" Fixed Wireless Access technology, operates at 3.5 GHz and connects to users through a pizza-sized dish.⁴⁸ Attached to the exterior of a building, the dish receives signals from a central 163-foot tall transmitter.⁴⁹ The new system has been installed in about 100 homes on the reservation of 6,000 people.⁵⁰ Monthly service for the system costs about \$13 and long distance calls are 10 cents a minute.⁵¹ The service includes call waiting, voice mail, and three-way calling.⁵² Antenna installation costs \$60 and takes about two hours.⁵³

3. Upperbands (24 to 39 GHz)

Communications, Inc., Jul. 30, 1998; SkyLynx Communications, Inc., *Wireless Markets* (visited Jun. 14, 1999) <<http://www.skylynx.com>>.

⁴⁵ *SkyLynx Communications Enters Sarasota Wireless Market*, News Release, SkyLynx Communications, Inc., Dec. 16, 1998; SkyLynx Communications, Inc., *Welcome to SkyLynx* (visited Feb. 23, 1999) <<http://www.skylynx.com/home.html>>.

⁴⁶ Marcia Martinek, *Rural Regional & Remunerative*, WIRELESS REVIEW, Feb. 1, 1999.

⁴⁷ Carol Sowers, *High-Tech Phones for Tribe Salt River Reservation 1st to Use Small Dish*, THE ARIZONA REPUBLIC, Dec. 12, 1998 ("Sowers").

⁴⁸ David Trinkwon, Director - Market development, Fixed Wireless Access, Nortel Networks, *New Fixed Wireless Access Solutions . . . Now "Alive" in the USA*, Presentation to NARUC, Orlando, Florida, Nov. 6, 1998.

⁴⁹ *Sowers*.

⁵⁰ *Id.* The service is operated by a tribal telecommunications division, Saddleback Communications, and its subcontractor, Mountain Telecommunications, Inc. David Trinkwon, Director - Market Development, Fixed Wireless Access, Nortel Networks, *New Fixed Wireless Access Solutions . . . Now "Alive" in the USA*, Presentation to NARUC, Orlando, Florida, Nov. 6, 1998.

⁵¹ *Sowers*.

⁵² *Id.*

⁵³ *Id.*

The largest commercial deployment of fixed wireless systems has occurred in the "upperbands" of the spectrum, in the 24 GHz (DEMS), 28 GHz (LMDS), and 39 GHz ranges.⁵⁴ The most significant operators in these bands, Teligent, Inc. ("Teligent") and WinStar Communications, Inc. ("WinStar"), are concentrating on business customers. However, the recently auctioned LMDS spectrum may create more residential services.⁵⁵

a. 24 GHz (DEMS)

Teligent - Teligent provides a bundle of broadband fixed wireless telecom services to small and medium sized businesses using its 24 GHz licenses.⁵⁶ Teligent has also made significant strides in its business since the writing of the *Third Report*. As of June 1999, the company had entered 28 markets covering 83 million people and plans to enter 12 additional markets by the end of 1999.⁵⁷ Teligent's licenses cover 74 markets nationwide and the company plans to enter all these markets by the end of 2001.⁵⁸ By the end of 1998, the company had secured access rights to nearly 2,400 buildings and had installed 13 Nortel DMS switches.⁵⁹

b. 28 GHz (LMDS)

A Local Multipoint Distribution Service system is capable of offering subscribers a variety of one- and two-way broadband services, such as video programming distribution, video teleconferencing, and wireless local loop telephony, as well as Internet access and other high speed data transmission services. Because of its multi-purpose applications, LMDS has the potential to become a major competitor to local exchange carriers and cable television providers, although it appears that LMDS operators plan to concentrate on voice and data services.⁶⁰ There

⁵⁴ DEMS spans 24.25 - 25.25 GHz; LMDS spans 27.5 - 31.3 GHz; 39 GHz spans 38.6 - 40.0 GHz. 39 GHz is often referred to as 38 GHz. See Table 2 at F-18 for a summary of current service offerings by upperband operators.

⁵⁵ Jeff Bounds, *Uncertain Future: Will the Market Accept LMDS? Bosch, Others Gamble on New Technology*, DALLAS BUSINESS JOURNAL, Jul. 3, 1998.

⁵⁶ Teligent, Inc., *New! Local Private Line Keeps Your Business Connected* (visited Feb. 27, 1999) <<http://www.teligent.com>>.

⁵⁷ *Teligent Brings More Bandwidth at Lower Cost to Seattle Small and Mid-Sized Businesses*, News Release, Teligent, Inc., Jun. 8, 1999. See Appendix H, Map 13 at H-13.

⁵⁸ *Teligent Reports Third Quarter Financial Results, Completes Launch of First 15 Markets*, News Release, Teligent, Inc., Nov. 11, 1998.

⁵⁹ *Teligent Reports 1998 Financial Results, Sets Operating Benchmarks for 1999*, News Release, Teligent, Inc., Mar. 1, 1999; *Teligent Reports Third Quarter Financial Results, Completes Launch of First 15 Markets*, News Release, Teligent, Inc., Nov. 11, 1998.

⁶⁰ See, e.g., Ken Freed, *NextLink Slowly Positions for Big Wireless Play*, INTERACTIVE WEEK, Feb. 15, 1999.

is currently only one operational, commercial LMDS provider: SPEEDUS.COM, Inc. (formerly Cellularvision USA). SPEEDUS.COM offers high-speed Internet access, up to 48 Mbps downstream, to business and residential users in Manhattan, Brooklyn, and Queens, NY.

The Commission completed an LMDS auction in March 1998.⁶¹ LMDS licensees plan to offer a mix of the fixed wireless services mentioned above, especially high-speed Internet access and other data services.⁶² While many are waiting for the technological standards and specifications to be set and for the LMDS technology to mature,⁶³ some licensees have taken the first steps in building their networks. Some have signed contracts with equipment manufacturers, run trials of their networks, and/or have announced plans for service offerings.⁶⁴ Most of these licensees are either established telecommunications companies that plan to expand their networks and enhance their service offerings or business ventures of utility companies that want to bring advanced services to rural areas not served by fiber. In October 1998, nine percent of LMDS licensees stated they planned to deploy their networks within a year and 50 percent plan to offer services in the next three to five years.⁶⁵ LMDS operators are expected to offer their services mainly to small and medium sized businesses.⁶⁶ Analysts predict that nine percent of broadband users will access the Internet via LMDS in 2003⁶⁷ and that LMDS revenues will total \$241 million in 1999 and over \$6 billion by 2007.⁶⁸ The Commission has scheduled an auction of additional LMDS licenses for April 27, 1999.⁶⁹

In one of the major developments since the close of the first LMDS auction, Nextlink Communications, Inc. ("Nextlink") a CLEC currently operating 25 fiber networks in 15 states and the District of Columbia,⁷⁰ announced two major acquisitions. In January 1999, Nextlink

⁶¹ See Appendix A, Tables 1 and 2 for summaries of the auction's design and outcome and *Third Report Appendixes*, at A-6 for a list of high bidders.

⁶² See *WinStar Wins 15 LMDS Licenses in FCC Auction*, News Release, WinStar Communications, Inc., Mar. 26, 1998; Jeannine Aversa, *Licenses for Wireless Service Auctioned*, THE WASHINGTON POST, Mar. 26, 1998, at C3.

⁶³ Cathy Stephens, *Jumpstarting LMDS*, PRIVATE CABLE & WIRELESS CABLE, Oct. 1998, at 18.

⁶⁴ See Table 3 at F-19 for a summary of current activity by recent LMDS auction winners.

⁶⁵ Cathy Stephens, *Jumpstarting LMDS*, PRIVATE CABLE & WIRELESS CABLE, Oct. 1998, at 18.

⁶⁶ Cathy Stephens, *Weighing the LMDS Architecture Options*, Private Cable & Wireless Cable, Jan. 1999, at 32 (quoting Phil Goetz, the chief architect for Lucent's broadband fixed wireless products); *Q&A with Thomas H. Jones of WNP Communications*, PRIVATE CABLE & WIRELESS CABLE, Nov. 1998, at 50.

⁶⁷ *Internet Industry Facts*, PRIVATE CABLE & WIRELESS CABLE, Dec. 1998, at 16.

⁶⁸ *LMDS Industry Facts*, PRIVATE CABLE & WIRELESS CABLE, Dec. 1998, at 11.

⁶⁹ "Auction of Local Multipoint Distribution Service Spectrum, Auction Notice and Filing Requirements for 168 Local Multipoint Distribution Service Licenses Scheduled for April 27, 1999, Minimum Opening Bids and Other Procedural Issues," *Public Notice*, DA 99-266 (rel. Jan. 29, 1999).

⁷⁰ Nextlink Communications, Inc., *Cities We Serve* (visited Jun. 14, 1999)

announced its acquisition of WNP Communications, Inc. ("WNP") and completed the acquisition in April 1999.⁷¹ WNP was the largest bidder in the LMDS auction, having acquired 40 licenses covering 114 million POPs. In addition, Nextlink announced an agreement with Nextel to purchase Nextel's interest in LMDS licensee Nextband Communications, LLC ("Nextband"). Nextlink and Nextel each own 50 percent of Nextband, which purchased 42 licenses in the LMDS auction. This acquisition will make Nextlink the sole owner of Nextband. When the two deals are completed, Nextlink will own spectrum covering all of the top 30 U.S. markets, most of which it plans to enter by the end of 1999.⁷² The company plans to use the spectrum as a complement to its fiber networks.⁷³ In June 1999, Nextlink also purchased two million shares of SPEEDUS.COM, Inc.⁷⁴

c. 39 GHz

WinStar - WinStar uses its 28 GHz and 39 GHz licenses to provide a package of WLL services, which it collectively calls "Wireless Fiber." WinStar sells local, long distance, high speed data, Internet access, and information services to business customers and resells its networks to other telecommunications carriers.⁷⁵ WinStar has grown significantly since the writing of the *Third Report*. The company now offers wireless CLEC services in the top 30 markets in the United States⁷⁶ and had 380,000 lines in service as of March 31, 1999.⁷⁷ WinStar plans to compete in 40 markets by the end of 1999 and states that it has the financial capabilities to enter 50 cities in

<<http://www.nextlink.com/usmap.html>>.

⁷¹ *NEXTLINK Communications To Acquire WNP Communications for \$695 Million*, News Release, Nextlink Communications, Inc., Jan. 14, 1999. On March 30, 1999, the FCC approved the assignment of WNP's licenses to Nextlink. "Wireless Telecommunications Bureau Public Safety and Private Wireless Division Grants Consent to Assign Authorizations of WNP Communications, Inc. and PCO Acquisition Corp.," *Public Notice*, DA 99-610 (rel. Mar. 30, 1999); *Nextlink Closes WNP Acquisition; Becomes Largest Holder of Fixed Wireless Spectrum in North America*, News Release, Nextlink Communications, Inc., Apr. 27, 1999.

⁷² See Appendix H, Map 14 at H-14.

⁷³ *McCaw's Big-Picture Strategy Comes into Clearer Focus as Nextel Chief Consolidates Domestic LMDS Holdings*, PCS WEEK, Jan. 27, 1999; *McCaw Aims to Consolidate Domestic LMDS Spectrum Holdings*, COMMUNICATIONS TODAY, Jan. 15, 1999.

⁷⁴ SPEEDUS.COM, Inc., *SPEEDUS.COM, Inc. and Nextlink Sign \$40 Million Pact, Nextlink Agrees to Purchase Two Million Shares at \$10 Per Share*, News Release, SPEEDUS.COM, Inc., June 14, 1999.

⁷⁵ These other carriers include CLECs, Competitive Access Providers ("CAPs"), inter-exchange carriers ("IXCs"), LECs, and Internet Service Providers ("ISPs").

⁷⁶ Winstar Communications, Inc., *Business Services* (visited Feb. 27, 1999) <<http://www.winstar.com/indexBuisServ.htm>>. See Appendix H, Map 15 at H-15.

⁷⁷ *WinStar Reports On-Net Building Penetration Jumps to 14 Percent*, News Release, WinStar Communications, Inc., May 12, 1999.

the U.S. and another 50 around the world.⁷⁸

WinStar adopted a strategy of not only connecting individual businesses but entire buildings to its network by contracting with owners of corporate real estate. WinStar had obtained access rights to more than 4,800 commercial buildings nationwide by March 1999⁷⁹ and has plans to obtain access to a total of 8,000 buildings by the end of 1999. These access rights enable WinStar to provide a building's tenants with a wide range of telecommunications services.⁸⁰

Advanced Radio Telecom, Inc. ("ART") - ART uses its 39 GHz licenses, as well as frame relay and ATM technology, to offer high-speed Internet access and other Internet services.⁸¹ ART began offering these services to business customers in Seattle, WA in September 1998, and in Portland, OR and Phoenix, AZ in December 1998.⁸² At the end of 1998, ART had access to 155 buildings, offered full network connectivity to 85 buildings, and had received 142 customer orders. In June 1999, Qwest Communications International Inc. purchased a 19 percent stake in ART. ART claims the investment will help the company fulfill its goal of building broadband wireless high-speed networks in 40 of the top 50 metropolitan areas over the next two years. ART plans to provide a full array of communications services including Internet access, Internet services, data transmission, fax, video conferencing, electronic commerce, and voice over IP.⁸³ ART has stated that its spectrum licenses combined with Qwest's 18,500-mile fiber network will allow ART to reach more than 50 percent of U.S. businesses.⁸⁴

ART's nationwide 38 GHz licenses cover 49 of the top 50 and 90 of the top 100 U.S. markets. In total, the licenses cover 210 markets with a population of over 186 million.⁸⁵ In June 1998,

⁷⁸ \$2 Billion Winstar / Lucent Strategic Agreement to Expand Winstar's Broadband Network, News Release, WinStar Communications, Inc., Oct. 22, 1998. In April 1998, WinStar purchased a 15 percent stake in Advanced Radio Telecom. *WinStar to Purchase 14.9% of Advanced Radio Telecom Corp.*, BUSINESS WIRE, Apr. 27, 1998.

⁷⁹ *Winstar Reports First Quarter Results*, News Release, WinStar Communications, Inc., May 12, 1999.

⁸⁰ *Winstar Achieves Access Rights to More Than 4,200 Commercial Buildings Nationwide*, News Release, WinStar Communications, Inc., Dec. 17, 1998.

⁸¹ Advanced Radio Telecom, Inc., *Technical Information* (visited Mar. 1, 1999) <<http://www.art-net.net/technical/tech.htm>>. Internet services include web hosting and e-commerce.

⁸² See Appendix I, Map 16 at I-16.

⁸³ *Advanced Radio Telecom Corp. Announces Operating Results for Fourth Quarter 1998*, News Release, Advanced Radio Telecom, Inc., Jan. 12, 1999; *Advanced Radio Telecom Launches Internet Services in Portland*, News Release, Advanced Radio Telecom, Inc., Dec. 21, 1998; *Advanced Radio Telecom Corp. Announces Operating Results for Fourth Quarter 1998*, News Release, Advanced Radio Telecom, Inc., Jan. 12, 1999; Advanced Radio Telecom, Inc., *Who We Are* (visited Mar. 1, 1999) <<http://www.art-net.net/about/who.htm>>.

⁸⁴ *Qwest Communications and Investor Group Commit \$251 Million to Advanced Radio Telecom To Expand Its High-Speed Local Wireless Network*, News Release, Advanced Radio Telecom Corp., June 1, 1999.

⁸⁵ *Advanced Radio Telecom Corp. Announces Operating Results for Fourth Quarter 1998*, News Release, Advanced Radio Telecom, Inc., Jan. 12, 1999.

ART purchased 23 additional 39 GHz licenses from Columbia Capital Corp. that cover 22 million POPs in 13 markets.⁸⁶

AT&T - Although AT&T owns 39 GHz licenses, there is little public information concerning how the company is using them.⁸⁷ AT&T obtained the licenses through its acquisition of Teleport Communications Group, Inc. ("TCG"), completed in July 1998.⁸⁸ At that time, TCG, now AT&T's business local services unit,⁸⁹ was the largest fiber-based CLEC in the United States and had obtained the licenses through its acquisition of Biztel Communications, Inc. in 1996. TCG primarily used its digital, fiber optic networks to deliver services, but would rely on its 39 GHz spectrum to connect customers to its fiber networks, to provide temporary installation when its fiber networks were down, and to provide stand-alone facilities where the company did not have fiber networks.⁹⁰ AT&T has said it plans to expand TCG's wireless local loop bypass business.⁹¹

C. Competitive Analysis

1. Strengths

In addition to providing new competition in existing markets, fixed wireless systems have the potential to provide new services and expand capacity into areas considered too expensive to enter using available wireline technologies. WLLs afford new entrants in a market direct access to an individual customer's building, limiting the reliance on LECs.

Lower Network Deployment Costs - Fixed wireless operators claim that their networks have a significantly lower cost structure than wireline systems for two primary reasons.⁹² First, wireless networks are free of the installation and maintenance costs incurred with wires. Second, unlike a wireline network in which an entire market must be wired before initiating service, the capital expenditures of a wireless network can be incrementally incurred as more customers are added. Because of this lower cost structure, operators have been able to charge significantly lower prices than wireline competitors for business services. Teligent, for example, offers its

⁸⁶ Telephony, COMMUNICATIONS DAILY, Jun. 4, 1998.

⁸⁷ See Appendix I, Map 17 at I-17.

⁸⁸ *AT&T Completes TCG Merger; TCG Now Core of AT&T Local Services Network Unit*, News Release, AT&T Corp., Jul. 23, 1998.

⁸⁹ Teleport Communications Group, Inc., *TCG Home Page* (visited Mar. 1, 1999) <<http://www.tcg.com>>.

⁹⁰ Teleport Communications Group, Inc., Form 10-K405, Dec. 31, 1996, at 10.

⁹¹ Bill Menezes, *MCI WorldCom Discovers Fixed Wireless*, WIRELESS WEEK, Feb. 8, 1999, at 25.

⁹² According to a WinStar, it can cost up to 85 percent less to provide phone service through the air than through a fiber network. Suzanne King, *Gaining a Foothold*, KANSAS CITY BUSINESS JOURNAL, Nov. 13, 1998.

subscribers a flat monthly rate which is up to a 30 percent discount compared to wireline providers.⁹³

High Capacity of Upperbands- Upperband licensees have large blocks of spectrum at their disposal, permitting high-capacity services, such as video conferencing and super-high-speed Internet access. Winstar claims to offer 200 Mbps speeds on its multipoint systems, 1500 times faster than an ISDN line (128 Kbps).⁹⁴ This capacity also permits providers to offer packages of local, long-distance, and Internet services.

Underserved Markets - There are a number of market segments with low penetration by existing broadband wireline systems. For example, only a small percentage of office buildings have broadband access.⁹⁵ Fixed wireless operators can act as strategic partners with wireline CLECs who wish to extend their fiber networks more cheaply to such buildings. Many small and medium sized businesses, too low volume for expensive fiber connections, are also potential customers.⁹⁶ In addition, wireless access has the potential to improve competition and broadband services for residential customers in both urban and rural markets.⁹⁷

2. Challenges

Along with the competitive advantages described above, fixed wireless providers face a

⁹³ To qualify for the maximum discount, customers switch their existing service -- local, long distance or Internet -- and sign up with Teligent for a minimum of one year. Teligent averages several representative bills from the customer's current carriers and deducts up to 30 percent. That figure becomes the customer's new flat monthly rate. Local and Internet service are unlimited. If customers wish to increase their long distance usage over current levels, they can purchase more service at what the company believes are attractive prices. *Teligent Introduces Revolutionary, Lower-Cost Communications Services In New Orleans*, News Release, Teligent, Inc., Feb. 25, 1999.

⁹⁴ See *Ex Parte* presentation materials of Winstar Communications, Inc., CC Docket No. 96-98; CS Docket 95-184; CCBPol 97-9; CC Docket 98-146; IB Docket No. 97-95 (FCC filed Nov. 20, 1998).

⁹⁵ Estimates of this large market vary. Teligent estimates that fiber networks today reach only 3 percent of the 750,000 office buildings in the U.S. (although the company conditions that that 3 percent actually reaches 35 percent of "fiber-addressable businesses"). Nancy Gohring, *Wireless Networks: Broadband Wireless Operators Build Their Case*, TELEPHONY, Jul. 6, 1998. Roberta Woods, director of Wireless Market Research at Pioneer Consulting, claims that 99 percent of the estimated 4.6 million commercial buildings in the United States are not served by fiber. Charles Mason, *LMDS: Huge Niche Technology*, AMERICA'S NETWORK, Sep. 1, 1998.

⁹⁶ WinStar believes small and medium sized businesses constitute 60 percent of all businesses in the United States and represent a market opportunity in excess of \$30 billion per year. Winstar Communications, Inc., Form 10-K, Dec. 31, 1997, at 6.

⁹⁷ Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, *Report*, CC Docket No. 98-146 (rel. Feb. 2, 1999), at ¶¶ 45-46.

number of challenges in establishing service. The challenges mentioned below are in addition to those faced by all CLECs such as obtaining interconnection agreements.⁹⁸

Access Barrier Issues - Fixed wireless providers have noted a number of barriers to access to customers' premises. Such barriers include roof rights as well as related inside building facilities and inside wiring. Fixed wireless providers need rooftop access on apartment and office buildings to place their transmitting and receiving antennas. Providers also need access to inside conduits and physical pathways from the building owner. In addition, providers require access to the building's inside wiring and riser cables to connect to the customer's telephone system.

Obtaining access can represent a long and tedious process, as individual contracts must be negotiated. Moreover, WinStar, Teligent, and others have claimed that certain building owners and managers have started to charge excessive fees, not based on a reasonable cost for access to roof and inside facilities, but as an opportunity to gather revenues. Such prices are discriminatory, they claim, as established incumbent LECs and cable providers are not asked to pay such fees.⁹⁹

State and Local Government Right-of-Way Requirements - Certain state and local governments have started to assess right-of-way franchise requirements and right-of-way fees on broadband fixed wireless licensees.¹⁰⁰ Wireless carriers argue that because they do not use the public rights-of-way, they should be exempt from franchise requirements.¹⁰¹ WinStar believes the effect of such actions will delay and possibly prohibit the provision of competitive local exchange service by new wireless entrants.

Universal Service Funding - Wireline local exchange carriers offer residential service discounted by the receipt of universal service funds. In order to receive funding, a fixed wireless operator, like all carriers, has to be designated an "Eligible Telecommunications Carrier" ("ETC") by the state in which it plans to operate.¹⁰² Some wireless providers consider some of these state rules

⁹⁸ As for all CLECs, the successful negotiation of these agreements on favorable terms is essential to the success of WLL. In addition, in the near term, providers of WLL will still need to rely on LECs for many of the unbundled network elements required to provide telephone service (e.g., switching and operator services). As fixed wireless access providers expand their operations and begin to take customers from incumbent LECs, disputes such as the one between Western Wireless and Consolidated Telephone (see above) may become more common.

⁹⁹ See WinStar Communications, Inc.'s Comments at 5; Teligent, Inc.'s Comments at 6-8, filed in response to "Common Carrier Bureau Seeks Recommendations on Commission Actions Critical to the Promotion of Efficient Local Exchange Competition," *Public Notice*, 12 FCC Rcd 10,343 (1997).

¹⁰⁰ WinStar argues it should not have to pay rights of way fees because its network is deployed on rooftops, which are private property, rather than the public rights-of way. See *id.*

¹⁰¹ In July 1998, a federal district court ordered the city of Dallas to halt imposition of franchise fees or linking payment of right-of-way charges with certifying new wireless carriers, saying such actions exceed regulatory limits under state and federal law. *U.S. Judge Rejects Dallas Bid to Impose Fees on Wireless Carriers*, COMMUNICATIONS DAILY, Jul. 8, 1998.

¹⁰² 47 U.S.C. 214(e)(2).

as discriminating unfairly against them.¹⁰³

Technical Issues - The propagation and technical characteristics of upperband frequencies present two major challenges. First, high frequency signals behave much more like visible light than cellular or PCS signals when obstacles such as terrain, buildings, and vegetation are encountered. These signals require line-of-sight between transmitter and receiver in order for a prospective customer to receive an adequate signal. To increase coverage, operators must increase the height of cell antennas or move cells closer together. Second, high frequency signals are easily scattered and absorbed by rain. An afternoon thunderburst, for example, can significantly reduce the effective range of an upperband system. Raising transmitter power output during these events helps reduce signal fading.

¹⁰³ Western Wireless Corp., Petition for Preemption, Pursuant to Section 253 of the Communications Act, of Kansas Statutes and Rules that Discriminate Against New Entrants, Jul. 20, 1998, at n. 18.

TABLE 1: INTERNET ACCESS OFFERINGS BY MMDS LICENSEES

Wireless Cable Operators			
Company	Location	Launch Date	Downstream Speed
American Telecasting (acquired by Sprint)	Colorado Springs, CO	Sep. 1997	750 kbps downstream, telephone return path
	Denver, CO; Portland, OR	Feb. 1998	750 kbps downstream, telephone return path
	Eugene, OR; Seattle, WA	Trial Demonstration 1998	Two-way
CAI Wireless Systems, Inc. (acquired by MCI WorldCom)	Washington, DC	N/A	Up to 27 Mbps downstream, telephone return path
CFW Communications	Charlottesville, VA	Sep. 1997	Up to 27 Mbps downstream, telephone return path
CS Wireless Systems, Inc.	Dallas/Fort Worth, TX	Nov. 1997	Up to 4 Mbps downstream; telephone, ISDN, or T-1 return path
Nucentrix (formerly Heartland Wireless Systems, Inc.)	Sherman, TX	Jun. 1998	768 kbps (one and two- way)
MagnaVision Corp.	New York, NY	Successful 6-month trial completed	1.5 Mbps or greater downstream
People's Choice TV Corp. (acquired by Sprint)	Detroit, MI	Oct. 1997	Up to 36 Mbps downstream, telephone or ISDN return path
	Phoenix, AZ	Mar. 1998	Same
Sioux Valley Wireless	Sioux Falls, SD	Dec. 1997	Up to 10 Mbps downstream, telephone or ISDN return path
Wireless One, Inc.	Jackson, MS	1998	MDS spectrum downstream, WCS return path
	Baton Rouge, LA	1998	Same
	Memphis, TN	Dec. 1998	Same

Other Providers			
Company	Location	Launch Date	Downstream Speed
Cache Valley AIRNET	Cache Valley, UT	N/A	Up to 10 Mbps downstream, telephone or ISDN return path
DirectNet	South Florida	Aug. 1997	1-2 Mbps downstream, telephone return path
IJNT International (formerly InterJetNet)	Salt Lake City, UT	Aug. 1997	Up to 10 Mbps (one and two-way)
	Beaumont, TX	Sep. 1997	Same
	Houston, TX	N/A	Same
	Orange County, CA	Dec. 1998	Same
	San Francisco Bay Area, CA	Dec. 1998	Same
	Provo-Orem, UT	Apr. 1999	Same
Le Groupe Videotron/Wavepath	San Francisco, CA	Dec. 1998	384 kbps (two-way)
Metro.Net	Northern California	N/A	Up to 10 Mbps downstream, telephone or ISDN return path
SkyLynx Communications, Inc.	Tampa, FL	4th Q 1998	Up to 30 Mbps downstream, up to 11 Mbps upstream
	Fresno, CA	N/A	Same
UltimateCom, LLC	Atlanta, GA	Mar. 1998	N/A , telephone return path
	Denver, CO	N/A	3 Mbps (two-way)

TABLE 2: UPPERBAND FIXED WIRELESS OPERATORS

Company	Spectrum	Rollout Areas	Subscribers	Services
WinStar	28 and 38 GHz	Top 30 markets in the U.S.	380,000 lines in service	Voice, high speed data, Internet access, and information services
Teligent	24 GHz	28 markets nationwide	Access rights to 2,400 buildings	Voice, high speed data, Internet access, and information services
ART	38 GHz	Seattle, WA Portland, OR Phoenix, AZ	Access rights to 155 buildings	High-speed Internet access and Internet services
AT&T (Biztel/TCG)	38 GHz			TCG used as back-up and extension of fiber network; AT&T use unclear.
SpeedUs.com (formerly Cellularvision)	28 GHz (LMDS)	New York City Metro Area	2,000	Internet access (up to 48 Mbps downstream, telephone return path)

TABLE 3: RECENT LMDS AUCTION WINNERS

Company	POPs	Major License Areas	Announced Plans
Nextlink Communications, Inc.	50.8 million (A) 35.8 million (B)	most major U.S. cities	Acquired licenses of WNP and Nextband; plans to offer LMDS commercially as a complement to its CLEC fiber networks by end of 1999
WinStar	14.7 million (A) 2.3 million (B)	San Francisco, New Orleans, Salt Lake City, Norfolk, Orlando, other parts of California	Use of LMDS in conjunction with its 38 GHz spectrum to extend its reach to other cities
Touch America, Inc.	2.1 million (A) 2.1 million (B)	parts of Montana, Wyoming, Utah, Colorado, Idaho, North Dakota, Washington, Minnesota	Begin LMDS buildout in Helena and Billings, MT; use spectrum to link 30 cities to its 10,000 mile fiber network; and equipment contract with Nortel
BTA Associates	3.0 million (A) 675,000 (B)	Colorado	Begin offering LMDS services by the end of 1999
Liberty Cellular, Inc.	1.0 million (A) 1.0 million (B)	throughout Kansas	Begin offering LMDS service by late 1999; equipment contract with Nortel
US Unwired	1.8 million (A) 325,000 (B)	Louisiana, eastern Texas	Use of LMDS licenses to expand and complement its existing CLEC network and services
Virginia Tech Foundation, Inc.	1.5 million (A)	Southwest Virginia	Began LMDS deployment in Blacksburg, VA in May 1999; equipment donated by Wavtrace.
Home Telephone Company, Inc.	624,000 (A)	Charleston, SC	Begin deploying network in mid-1999; equipment contract with Newbridge Networks
Tri-Corner Telecommunications, Inc.	163,000 (A and B)	Durango, CO, Farmington, NM	Begin offering LMDS services by the end of 1999

(A) indicates BTA A Block which consists of 1,150 MHz

(B) indicates BTA B Block which consists of 150 MHz